Cuban Lizards of the Genus *Chamaeleolis*

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The endemic Cuban lizards of the genus *Chamaeleolis* Duméril and Bibron are among the most bizarre of the anoline lizards in the West Indies. Reaching snout-vent lengths somewhat in excess of 170 mm, *Chamaeleolis* is structurally characterized by its prominent bony head casque (a feature which it shares with *Anolis equestris* Merrem) and its peculiar body scalation, consisting of large, flat, irregularly shaped and sized dorsal and lateral scales. The behavior of *Chamaeleolis* is equally peculiar; in contrast to the agility of the similarly sized *A. equestris*, *Chamaeleolis* is deliberate and slow, in the fashion of some of the lower primates and Old World chamaeleontids. Wilson (1957), commenting on an individual in captivity, noted that the lizard "could be left on a laboratory table without much danger of wandering far away; it would often remain in the same spot for hours or even days without changing its position." Its lack of aggressiveness was demonstrated by Wilson's placing a live male *A. equestris* and a cardboard model resembling a male *Chamaeleolis* near it without eliciting any overt response. The lizard might best be described as extremely lethargic and phlegmatic; the few specimens observed in the field by the junior author confirm the sluggishness of *Chamaeleolis*, and Ruibal (1964, p. 482) noted that specimens secured by him likewise did not attempt to escape.

Possibly owing at least in part to its slowness and consequent inconspicuousness, *Chamaeleolis* has always been rare in herpetological collections made in Cuba. Stejneger (1917, pp. 267-268) listed the specimens in the United States National Museum; Barbour and Ramsden (1919, p. 129) noted its widespread occurrence in Cuba but regarded it as rare. Ruibal (1964, p. 480) listed the genus as occurring in all the provinces of Cuba. The rarity of *Chamaeleolis* in collections has formerly precluded any analysis of variation in the genus, and it has been to our great good fortune that we have been able to bring together a very large percentage of specimens in both Cuban and American collections (which, interestingly, nicely supplement one another as far as geographical coverage of Cuba is concerned). We have examined specimens in the American Museum of Natural History (AMNH),

Museum of Comparative Zoology (MCZ), Museum of Zoology, University of Michigan (UMMZ), and United States National Museum (USNM)—a total of 30 lizards; for the opportunity to study these specimens we are indebted to Charles M. Bogert and George W. Foley, Ernest E. Williams, Charles F. Walker, Doris M. Cochran, and James A. Peters. A similar courtesy has been extended us by the curators of several Cuban collections: we have examined material from the Museo Poey at the Universidad de la Habana (MP), including those formerly housed at the Universidad de Oriente (UO), and the collections of Miguel L. Jaume (MJ) and Mario S. Buide (MSB). We are grateful to Carlos Storch, Dario Guitart, and Vitelio Vitier, as well as to Srs. Jaume and Buide, for allowing us to examine the specimens in their care. Additionally, Héctor Sagué D., director of the Instituto de Biología, Academia de Ciencias, has greatly facilitated our work; specimens in the collection of the Instituto de Biología are designated by IB. There are 38 *Chamaeleolis* in Cuban collections, bringing the number of specimens examined by us to a total of 68. Two specimens have been placed in the Albert Schwartz Field Series (ASFS). No previous workers have examined conjointly such a number of these rare lizards.

We wish also to thank Edmond V. Malnate both for his information on the specimens of *Chamaeleolis* in the Academy of Natural Sciences of Philadelphia (ANSP) and for his assistance with literature. Similar information has been generously provided by Jean Guibé on original material in the Muséum National d'Histoire Naturelle (MNHN) in Paris. Margaret S. Shaw at the American Museum and Thomas W. Schoener at Harvard University have been extremely helpful in the matter of literature. The junior author was able to carry out his collecting in Cuba between 1957 and 1960 with the aid of two National Science Foundation grants (G-3865 and G-6252) which are hereby gratefully acknowledged. The illustrations are the work of David C. Leber.

The present paper stems from observations made by the senior author while comparing material collected by himself and by Charles T. Ramsden (housed today in the Universidad de Oriente) with specimens from more western Cuban localities. Even casual study convinced him that *Chamaeleolis,* rather than being mono-

typic as had been uninimously held, was composed of two distinct species, which differed strikingly in several characters. This information was relayed to the junior author who in turn borrowed the *Chamaeleolis* in American collections and quickly confirmed the existence of two species. The differences between them are remarkable and very distinctive; surely only the lack of abundant comparative material has prevented previous workers (with the notable exception of Cope) from reaching the same conclusion. The junior author had unwittingly collected specimens of both species (four of one, one of the other) and was unaware, like others, that differences observed between them were anything more than individual variation. Such is not the case, and the two species are readily diagnosible on the basis of many characters of scutellation and apparently by some phases of their respective color repertories and patterns.

Four trivial names have been applied to these distinctive lizards. The earliest name is *chamaeleonides* Duméril and Bibron, 1837, followed by *fernandina* Cocteau, 1838 or 1839 (we follow, in dating names in de la Sagra's *Historia física, política y natural de la isla de Cuba,* the rationale outlined by Smith and Grant, 1958, for the earliest date for the Spanish edition and attribute the name solely to Cocteau rather than to Cocteau and Bibron in accordance with Smith and Grant's review), *cocteaui* Fitzinger, 1843, and *porcus* Cope, 1864. The generic name, although formally proposed and diagnosed by Cocteau and Bibron, had been previously used by Duméril and Bibron (1837, pp. 168, 171) in reference to Cocteau's work; this previous usage seems adequate, in accordance with Articles 11 and 12 of the *International Code,* to attribute the generic name *Chamaeleolis* to Duméril and Bibron, as has been done by Romer (1956, p. 535). The apparent anomaly of Duméril and Bibron referring to an (apparently) as yet unpublished name may be resolved by considering the fact that Bibron worked with Cocteau on the reptile section of de la Sagra and was thus familiar in advance with any nomenclatural changes to be made in the latter work. It is perhaps fortunate that the generic name *Chamaeleolis* can be attributed to Duméril and Bibron, since in the Spanish edition of de la Sagra, the name is spelled variously—*Chamoelolis* (pp. 72 and 73, in a discussion of Cuban anoline lizards), *Chamaeleolis*

(p. 90, where the generic name is formally proposed), and *Chamaeolis* (p. 90, where the trivial name *fernandina* is proposed). We would also like to point out that many authors have spelled the trivial name "chamaeleontides" and have attributed this variant to Duméril and Bibron. There is no justification for this spelling since Duméril and Bibron spelled the specific epithet without the *t*, and we have followed their original orthography.

At least one of the four proposed trivial names (*porcus*) is readily identifiable from the original description. Mr. Malnate has checked the holotype for us and found that it agrees excellently with the diagnosis proposed by Cope (1864, p. 168). The three older names (*chamaeleonides, fernandina, cocteaui*) are less clearly identifiable on the basis of their original descriptions, *cocteaui* being especially so. However, Dr. Guibé (*in litt.*, 22 November 1966) advised us that these three names are based upon the same specimen (MNHN 1004), so that there is no question of either *fernandina* or *cocteaui* being anything other than direct synonyms of the prior *chamaeleonides.*

There is some oblique evidence that *fernandina* Cocteau may have priority over *chamaeleonides* Duméril and Bibron. These latter authors (1837, p. 168, 171) referred to *Chamaeleolis Fernandina* Cocteau and commented that "Notre Anolis caméléonide est pour M. Th. Cocteau le type d'un genre particulier auquel il assigne pour principal caractére d' avoir l'écaillure ventrale granuleuse. Le nom par lequel il le désigne est celui de Chamaeleolis." Such a statement clearly implies that Duméril and Bibron were aware of Cocteau's (proposed) generic name as noted before. Duméril and Bibron (p. 168) mentioned the name as appearing in table 12 of the French edition of the de la Sagra work, but made no further comment on pagination of the Cocteau description in the French edition. Whether their reference was due to foreknowledge of Cocteau's work (since Cocteau and Bibron worked together on the reptile section of de la Sagra) or to their having seen it in print is equivocal. Since Smith and Grant (1958) have gone to considerable effort to establish dates and authorships for published names in de la Sagra's *Historia,* and since their research indicates that Duméril and Bibron antedate de la Sagra by a year, it seems pointless to pursue this line of reasoning further. It is possible that *fernandina* Cocteau antedates *chamaeleonides*

Duméril and Bibron, but rather than assume this as fact, we have adhered to the dating of these two works by Smith and Grant and continue to use *chamaeleonides* as the prior name.

Although the two species differ from one another in several scale characters, the most easily recognized feature is the difference between the median gular scales. Both sexes of *Chamaeleolis* have a large, wrinkled, and minutely scaled dewlap. Beginning at the chin and extending posteriorly to about the anterior distensible portion of the dewlap proper there is a pair of enlarged paramedian rows of scales. In one species (Fig. 1, left), these scales are short, squat, conical or more or less pyramidal, and set next to each other in an uninterrupted series except for occasional smaller scales. In the other species (Fig. 1, right), the paramedian gulars are elongate, flexible, barbel-like, and separated

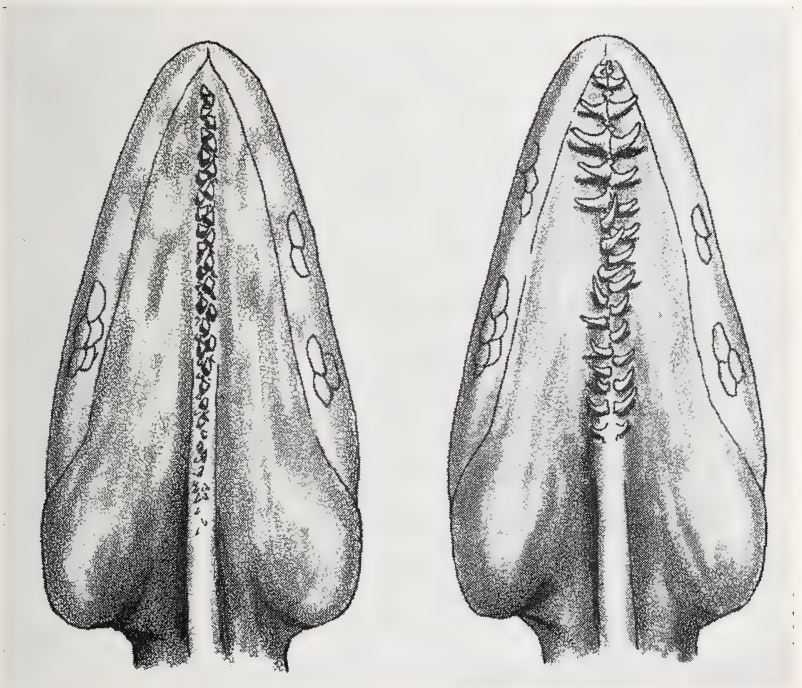

Fig. 1. Diagrammatic representation of paramedian gular scales (left) in *Chamaeleolis chamaeleonides,* based upon USNM 27497 and (right) in *Chamaeleolis porcus,* based upon USNM 29837.

from each other by several to many much smaller tiny granular or irregularly shaped scales. These two types of paramedian gular scale arrangements are correlated with a constellation of other features of scutellation which show no intermediates. We have no doubt whatsoever that we are dealing with two distinct species which appear to be broadly sympatric over much of Cuba (with the interesting and possibly significant exception of much of Oriente Province). The distributions of the two species are puzzling, and in no one place have both been taken precisely together (although we attach little importance to this fact since the total number of specimens is small for such a large island as Cuba and the maximum number of either species from a single locality is 10—Bayate, Guantánamo, Oriente Province). Detailed discussions of the distributions of the species must be preceded by clarification of the nomenclature.

Systematic Account

Chamaeleolis chamaeleonides Duméril and Bibron

Anolis chamaeleonides Duméril and Bibron. 1837. Erp. gén., vol. 4, p. 168.
Chamaeolis [sic] *fernandina* Cocteau. 1838 or 1839, *in* de la Sagra, *Historia física, política, y natural de la isla de Cuba,* vol. 4, Reptiles y Peces, p. 90.
Pseudochamaeleon cocteaui Fitzinger, 1843, Syst. Rep., p. 63.

Type locality. Cuba; here restricted to the vicinity of La Habana, Habana Province, Cuba.

Distribution. Cuba, from Pinar del Río Province in the west as far east as southwestern Oriente Province in the east; unknown east of a line drawn vertically between Gibara in the north and Pico Turquino in the south (Fig. 2).

Definition. A species of *Chamaeleolis* characterized by a combination of 1) paramedian gular scales small, truncate, short, conical to pyramidal (Fig. 1), 2) supralabials separated from circumorbital ring by one (occasionally two) row of scales, 3) dorsal scales subcircular to irregularly shaped with many smaller interstitial scales, 4) ventral scales small to tiny, 42 to 83 in distance equal to length from tip of snout to anterior bony border of orbit, 5) zone of transition between large lateral scales and tiny ventral scales relatively gradual, 6) scales on lower jaw below

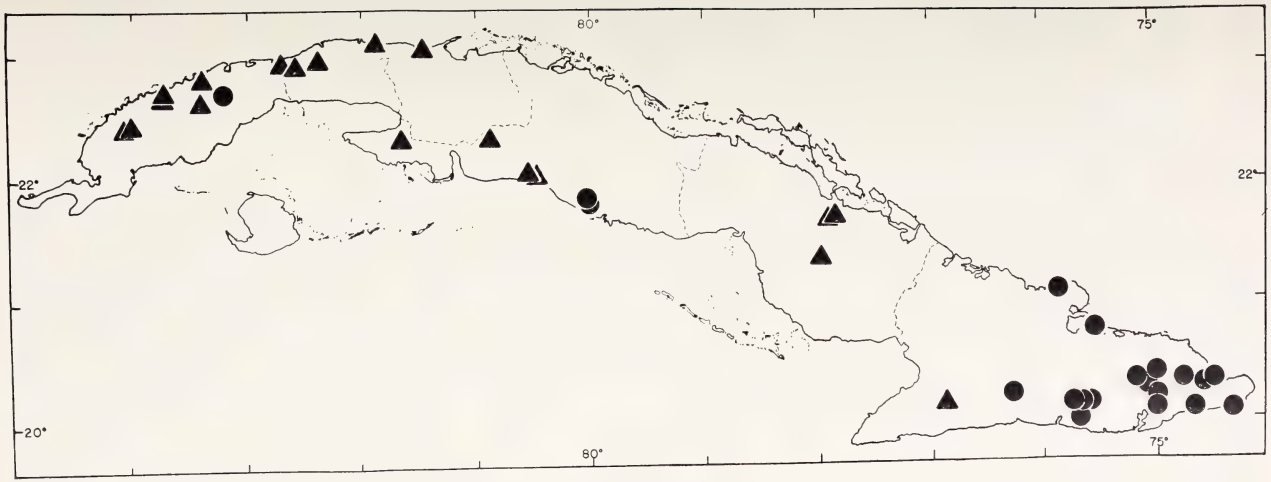

Fig. 2. Map of Cuba, showing distribution of two species of *Chamaeleolis*. Triangles, *C. chamaeleonides;* circles, *C. porcus*.

angle of jaw heavily rugose, and 7) posterior expanded portion of casque with relatively large scales.

Discussion. Throughout its broad range, *C. chamaeleonides* is constant in the diagnostic characters noted above. The shape of the paramedian gulars is variable, but the variation is not correlated with either sex or geography and seems merely to be individual. The paramedian gulars have their bases appressed to one another and are very rarely separated by occasional intermediate scales similar to the small adjacent gulars. The paramedian gulars are never long and filamentous or barbel-like as they are in the other species. The second most easily determinable character of *C. chamaeleonides* is the heavy rugosity of the scales below the angle of the jaw on the lower mandible. Although most lateral head scales are somewhat rugose, those in this particular area are especially so, and the two species can easily be separated merely by running the finger over the scales below the angle of the jaw. Two small specimens (snout-vent lenghts 46 and 54 mm) lack these asperities, but all lizards in excess of 90 mm snout-vent length show them clearly and not appreciably less well developed than large adults.

The dorsal scales on either side of the dorsal midline do not differ in size, shape or arrangement from those of the sides; the more dorsal rows have the scales subcircular or irregular in outline, and scattered between them are many tiny interstitial scales. The lateral scales are like the dorsals in configuration and in having surrounding granules. The zone of transition between the lateral scales and the ventrals is more gradual than the condition in the second species. The ventrals are small and somewhat variable in size between individuals and are about the same size as the unspecialized lateral gular scales.

The largest male (USNM 51891), a truly giant and bulky lizard, has a snout-vent length of 177 mm; the largest female (MCZ 38419) has an almost equal snout-vent length of 172 mm. The sexes are easily distinguished externally by the presence of a pair of conspicuously enlarged postanal scales in the males; both males and females have dewlaps. The smallest specimen examined (MCZ 13328, a female, snout-vent length 46 mm) has the umbilicus still unclosed.

Through the courtesy of Dr. Guibé and the cooperation of Dr.

Williams we have examined the holotype of *Anolis chamaeleonides* Duméril and Bibron (MNHN 1004); it is an adult female with a snout-vent length of 160 mm, short and squat paramedian gulars, and 61 ventrals in the snout-eye distance. The specimen departs slightly from our concept of *C. chamaeleonides* in that the supralabials are not quite completely separated from the circumorbital ring by a complete row of scales on the left side. The anomaly is doubtless due to the fact that the scales involved are irregular in configuration in the holotype, probably because of an old injury.

The use of the snout-eye distance as a standard for counting dorsal scales in *Anolis equestris* (Schwartz, 1964) has been employed in counting ventral scales in the present study. The comments made by Schwartz (1964, p. 408) apply equally well to making counts of ventral scales in *Chamaeleolis*. A reasonably accurate count can be made on specimens which have been preserved in an extended position, but material which has been curled in a jar when preserved inhibits making counts which are as accurate as we would like. Nevertheless, the rather gross differences in numbers of ventrals between the two species (despite a small amount of overlap in counts) make us sure that there is indeed a very distinct difference in number of ventrals in the snout-eye distance. Mere inspection of specimens of both species reassures the observer that there is a strong basic difference, which we have attempted to quantify by using a "standard distance."

A criticism of the snout-eye distance is of course the difference in relative and actual snout length between juveniles and adults. Small *C. chamaeleonides* are not mere miniature adults; the casque is barely indicated and the snout is short and not attenuate as it is in subadult and full grown lizards. However, the ventral counts on the two small juveniles in our series (46 and 63 scales) fall within the parameters established from adult lizards (42 ventrals at the lower extreme on two females with snout-vent lengths of 157 and 158 mm, 83 ventrals on a male with snout-vent length of 177 mm), so that there is no skewing of data from the inclusion of these two tiny lizards with their much larger relatives.

Three specimens taken by the junior author and Ronald F. Klinikowski in 1959 and 1960 at Los Paredones, Camagüey Province, in the Sierra de Cubitas, were encountered at night. A

small male was sleeping on a limb of a coffee tree about 5 feet (1.5 meters) above the ground. A large male and a small male were collected near to one another on a tree limb (the larger lizard) about 12 feet (3.7 meters) above the ground and on a pendant vine about 6 feet (1.8 meters) above the ground. In both these latter instances, the lizards were sleeping on substrata which about equalled the diameters of the lizards themselves. In no case was there any attempt at concealment, and the *Chamaeleolis* were fully exposed. The specimen from near San Vicente, Pinar del Río Province, was collected by a native from an exposed fence post 3 feet (0.9 meters) above the ground.

Field notes on the living male (AMNH 78073) *C. chamaeleonides* from San Vicente were as follows: dorsum light gray, venter pure white with black to gray spots; dewlap white with four purplish (Pl. 10, I 4; Maerz and Paul, 1950) blotches. Tail with seven purplish to violet bands and tail tip; legs banded with purple, toes black. A few scattered purple scales on side of body. Tongue inky blue posteriorly and anteriorly, with a yellowish transverse area between the base and blue-black tip. A male from Los Paredones (AMNH 83625) was dorsally gray with black reticulations; the legs were faintly greenish and the dewlap very pale peach at its edge and grayer basally.

An adult female (IB 1149) from Monte Alto near Juraguá, Las Villas Province, had the body grayish and brown with black spots, vermiculations, and dots. There was a coal-black spot, larger than about four or five of the smaller dorsal spots combined, above the axilla. The casque was completely spotted with black dots, and more widely separated black spots occurred on the face and sides. The fused eyelids were beige with six or seven brown rays extending from them. The iris was black with a yellowish ring. The venter was whitish with leopard-like spots on the sides at the junction of lateral scales with the smaller ventrals, under the hindlimbs, in the region of the vent, on the throat, and on the anterior portion of the dewlap. The spots gave the appearance of the result from splashings of dirty water, having a color between clear brown and yellowish. The dewlap was basally brownish violet and distally pale pink. After death, the grayish spots and reticulations on the head and body became black, so much so that the head became completely black.

An adult female (IB 1086) from Cinco Tiras near Juraguá, Las Villas Province, was grayish to beige in life, with a series of black reticulations over the whole body, most noticeably on the sides of the venter and along the sides of the dorsal crest. The limbs were lightly greenish over gray with three poorly visible stripes on the forelimbs. The casque was reticulated or spotted with blackish dots and spots. The dorsal reticulations continued (in brown) on the sides of the face behind the orbits and along the upper labials. The eyelids were grayish with about six grayish radiating lines. Behind the head and above the shoulder there was a blackish spot, narrower below and broader above. There were no transverse bars on the tail or on the back, although on the former there were remnants of some darker spots on the gray ground. The ventral color was sandy white with dirty yellow spots as far as the throat. The dewlap on either side of the paramedian scales was spotted with circular leopard-like spots, some brownish and others yellowish. The ground color of the dewlap was dull whitish pink, crossed by about six diffuse whitish bars; the central portions of these bands were marked with grayish green, and the base of the dewlap was yellowish. The underparts of the limbs and tail were spotted with a dirty brownish.

A third specimen (a male, ASFS V11171) from the same region resembled the above descriptions in several features of body color and pattern. The dewlap, after the lizard had been preserved for a week, was recorded as having a yellow ground crossed by three peach-colored bands.

From the above notes it is obvious that *C. chamaeleonides* has a great versatility in its color and pattern repertory. Our experience is limited, and we are unaware which of the above data may be individual or which may be due to regional (subspecific?) differences in pattern and color. Relatively recently and carefully preserved *C. chamaeleonides* regularly show some sort of throat spotting, either light spots on a dark ground, or dark spots on a light ground (usually the latter); this is a feature which we did not observe in any living or preserved specimens of the second species, and we conclude that the latter lacks this style of pattern in its repertory. Much additional material will be needed to demonstrate whether there are indeed subspecies of *C. chamaeleonides* based upon pattern and color. As far as our

present data are concerned, there are suggestions that there may be such geographically correlated differences in pattern, but the species remains uniform in scutellation throughout its range.

C. chamaeleonides occurs from Pinar del Río Province to western Oriente Province. It alone has been collected in the provinces of Habana, Matanzas, and Camagüey; although the second species is known from one specimen from Pinar del Río Province, *C. chamaeleonides* is the dominant form in western Cuba and is presumably so in central Cuba at least as far east as Camagüey Province. There are specimens from sea-level (La Mulata, Pinar del Río Province; Punta de Maya, Matanzas Province) to elevations of about 1000 feet (305 meters) in the Sierra de los Organos in Pinar del Río Province and about the same height at Los Paredones in the Sierra de Cubitas, Camagüey Province.

Ruibal (1964, p. 482) noted that "*C. chamaeleonides*" was restricted to the shaded portions of broadleaf forest; the five specimens of *Chamaeleolis* collected by him are all *C. chamaeleonides* so his remarks can be applied without hesitation to the habitat of this species. Our experiences confirm the occurrence of *C. chamaeleonides* in forested areas, although it does on occasion resort to more open situations (i.e., the individual collected on an exposed fencepost at San Vicente).

Stejneger (1917, p. 268) reported *C. chamaeleonides* from two further localities in Pinar del Río Province—Cabañas and Cabo de San Antonio. The specimens confirming these records are no longer in the United States National Museum, but there is of course no reason to doubt them. The Cabo de San Antonio locality is exceptionally interesting, since the area immediately about the cape is one of xeric coastal woods. Perhaps in extreme western Cuba, *C. chamaeleonides* survives in such a habitat in sharp contrast to the more mesic forests which it usually occupies elsewhere. There is no assurance that the species at Cabo de San Antonio is *chamaeleonides*, but we expect it there in geographical grounds. It should also be pointed out that the figure (Stejneger, 1917, fig. 35) of the lateral view of the head of a specimen (USNM 27502) from San Diego de los Baños, Pinar del Río Province, shows the supralabials in contact with the circumorbital ring—a character which is not typical of *C. chamaeleonides*. The drawing is incorrect, and the two rows of scales in

this specimen are indeed separated by a complete row of small scales.

Specimens examined. Cuba, Pinar del Río Prov., Potrerito, Sumidero, 1 (MP); Sierra de Pica Pica, Sumidero, 1 (IB 1084); Baños San Vicente, 1 (MCZ 38419); 2 km N San Vicente, 1 (AMNH 78073); San Diego de los Baños, 3 (AMNH 58901, USNM 27502-03); La Mulata, 1 (USNM 51891); Sierra de Anafe, 1 (MJ); *Habana Prov.*, Caimito de Guayabal, 1 (MCZ 13328); Santiago de las Vegas, 2 (MCZ 7895, USNM 27497); Arroyo Bermejo, 1 (MSB 11a); *Matanzas Prov.*, Punta de Maya, 1 (MSB 11b); *Las Villas Prov.*, kilometer 13 from Santo Tomás, Ciénaga de Zapata, 1 (IB 1085); Aguada de Pasajeros, 1 (MCZ 8948); Cinco Tiras, near Juraguá, 1 (IB 1086); Monte Alto, 2 km SE Juraguá, 2 (ASFS V11171, IB 1149); *Camagüey Prov.*, Finca San Pablo, ca. 15 km SW Camagüey, 1 (MCZ 57933); Los Paredones, Sierra de Cubitas, 4 (AMNH 83625, AMNH 96555-56, MCZ 59329); near Los Paredones, 1 (MCZ 59330); *Oriente Prov.*, near Buey Arriba, SW of Bayamo, 1 (MCZ 59331); no locality data other than Cuba, 2 (MNHN 1004, AMNH 46101). There are three specimens (ANSP 8132, ANSP 11879, ANSP 11974) with locality data merely "Cuba" which we have not examined but which Edmond V. Malnate has checked for us and found to represent *C. chamaeleonides*.

Chamaeleolis porcus Cope

Chamaeleolis porcus Cope, 1864, Proc. Acad. Nat. Sci. Philadelphia, p. 168.

Type locality: Cuba; here restricted to the vicinity of the city of Guantánamo, Oriente Province, Cuba.

Distribution: Primarily the eastern two thirds of Oriente Province, east of a line drawn vertically between Gibara in the north and Pico Turquino in the south, but outlying populations occur in the Sierra de Trinidad in Las Villas Province and in the Sierra del Rosario in Pinar del Río Province (Fig. 3).

Definition. A species of *Chamaeleolis* characterized by a combination of 1) paramedian gular scales long, flexible, barbel-like (Fig. 1), 2) supralabials in (usually broad) contact with circumorbital ring, 3) scales in about four dorsalmost rows longer than broad (elongate oval in shape), with few or no tiny interstitial scales or granules, fairly sharply set off from balance of dorsal and lateral scales which likewise have very few or no interstitial scales between them, 4) ventral scales fairly large, 22 to 48 in distance equal to length from tip of snout to anterior bony border of orbit, 5) zone of transition between large lateral scales and smaller ventral scales relatively abrupt, 6) scales on lower jaw

below angle of jaw smooth or only very slightly irregular, and 7) posterior expanded portion of casque with relatively smaller scales.

Discussion. *C. porcus* occurs, as far as known, in three widely separated areas. The region of its broadest known distribution lies in the eastern two thirds of Oriente Province, where it is the only species known; in Oriente, marginal western stations for its occurrence are Playa de Guarda la Vaca in the north and near Los Negros in the south. Thanks to the interest of Charles T. Ramsden, who resided in the city of Guantánamo and whose coffee estates were located about that city and between Guantánamo and Santiago de Cuba, there is a splendid series of *C. porcus* from this region in Oriente. Material from elsewhere on the island is sparse; there are two specimens (MCZ 53598, USNM 156786) from the Sierra de Trinidad in Las Villas Province and a single specimen (MP) from Rangel in the Sierra del Rosario in Pinar del Río Province. The two Sierra de Trinidad lizards are the only representatives of the genus from that mountain range, but both *C. chamaeleonides* and *C. porcus* are known from the Sierra del Rosario, although the former is apparently more common there than the latter. *C. porcus* presents an extremely disjunct distributional pattern, with a main center in eastern Oriente.

The long, flexible, barbel-like paramedian gular scales at once separate *C. porcus* from *C. chamaeleonides.* No specimen examined shows any intermediacy in this character, despite, for instance, the juxtaposition of the two species in the Sierra del Rosario (Rangel and San Diego de los Baños) or in the Sierra Maestra (Los Negros and Buey Arriba). The individual elongate paramedian gulars in *C. porcus* usually do not have their bases approximated but rather have them separated by an interposed barbel-like scale in the preserved lizard seems to be placed atop a small raised mount, the slopes of which are covered with tiny granules. The precise shape of the elongate scales is variable, some being almost spicule-like and others with wider bases, with various degrees of intermediacy between these extremes. The scales are never short and squat as they are in *C. chamaeleonides.* There is no sexual difference in development of paramedian gulars, and little ontogenetic change, since juvenile *C. porcus* (40 mm in snout-vent length) are just as readily identified on this

basis as are much larger specimens. There is also little evidence of geographic variation in the development of the paramedian gular scales; the single subadult female from Rangel (snout-vent length 111 mm) has extremely long paramedian gulars with wide bases. The two Sierra de Trinidad lizards (males, with snout-vent lengths of 116 and 160 mm) do not differ in the condition of the gulars from Oriente specimens. Additional material from the Sierra del Rosario may show that this western population is racially distinct from the more eastern populations; the same may also be true of the Las Villas lizards, although the two specimens available do not differ appreciably from their Oriente relatives.

The largest male *C. porcus* has a snout-vent length of 162 mm, and the largest female 171 mm. Both species reach about the same size. On the chance that there might be a difference in casque development between *C. chamaeleonides* and *C. porcus,* measurements of casque length (from tip of snout to posterior margin of casque) and width (across widest portion of casque) were taken on all specimens of both species. Although there is an impression of greater casque development in *C. chamaeleonides,* measurements indicate that there are no differences between the species (or between the sexes of each species) in this character. The holotype of *C. porcus* (ANSP 8133) is a female with a snout-vent length of 149 mm.

The size of the ventral scales in *C. porcus* is considerably larger than those of *C. chamaeleonides.* The ranges of the counts in the two species (22 - 48 in *porcus,* 42 - 83 in *chamaeleonides*) overlap slightly, but the overlap is without particular significance due to the total number of scales involved in each species and to the possible minor inaccuracies of the counts, as previously noted. The contact between the supralabials and the circumorbital ring is a constant feature in *C. porcus.* Usually the contact is broad, but in a few specimens a few longitudinally elongate scales are interposed between the supralabials and the ring at one or both ends; however, they never completely separate the two scale features.

The most extensive recently collected series of *C. porcus* is that taken by the senior author at La Florida, Oriente Province. These five specimens showed a duality of coloration; they were

able to assume a pale phase (brownish gray or greenish gray) or to become black. All specimens were capable of becoming black, but in the pale phase two were regularly brownish gray and the remaining three were regularly greenish gray. Such differences are not due to the sex of the lizards involved, since there is a single male and four females in the series. The greenish lizards had the dewlap orangish yellow basally and medially, and in the region where the dewlap approached the throat the former was a bluish gray tone. Four well defined dark brownish bands crossed the dewlap. The face and sides of the head had irregular brown markings on a bluish or clear gray ground. The temple anterior to the ear opening was uniform clear gray. Those lizards which were brownish gray in the pale phase were an ashy brown. There was a grayish white supraaxillary patch on the shoulder. The color of the dewlap was generally the same in these brownish lizards as in the greenish gray individuals, although the yellow was brighter. The ventral color, especially near the limbs, was yellowish, becoming brownish. The tongue was completely black except for the sides which were grayish. The single juvenile from this same locality (IB 1093; snout-vent length 65 mm) was colored identically to the brownish gray adults.

Field notes on an adult female (AHMN 83626) from near Felicidad, Oriente Province, taken by the junior author, state only that the dewlap was dull purple; the lizard was collected on the base of a *Roystonea* in a very wet coffee plantation surrounded by hardwood forest.

Although the number of *C. porcus* available to us is much greater than *C. chamaeleonides*, none of the former species shows any indications of having been dotted or blotched in the fashion of the latter. It seems likely that, despite a probably wide variety of colors and patterns in *C. porcus*, this species never assumes a spotted or blotched phase. Inspection of specimens of both *C. chamaeleonides* and *C. porcus* does not reveal any constant features of pattern which may confidently be used to distinguish them; considering the known versalitity of *C. chamaeleonides* in this respect, it is doubtful that such differences would be determinable from preserved specimens.

The character of the dorsal and lateral scales which we use to distinguish *C. porcus* and *C. chamaeleonides* is difficult to state

except in broad terms. The more dorsal scale rows in *C. porcus* are composed of scales which are elongate and ovid (rather than subcircular or squarish as in *C. chamaeleonides*) and either lack or have only a very few scattered interstitial scales. Below these dorsal rows (more laterally), the scales become subcircular and more like those of *C. chamaeleonides* but continue to have very few or no interstitial scales. The transition zone between the enlarged laterals and the much smaller ventrals is, relative to the condition in *C. chamaeleonides*, abrupt in *C. porcus*; although we are convinced that the difference is real it is difficult to explain easily and impossible to quantify. It should be noted that we have not employed, in diagnosing the two species, the number of dorsals in any set distance on the back or sides. Attempts at making such counts end in failure, since the variable and intergrading sizes of the dorsal scales prevents taking any meaningful count.

There may also be differences between the two species in size and arrangement of head scales; we have partially diagnosed the species by the relative size of the scales on the expanded portion of the casque but have not emphasized this presumed difference. The problem with cephalic squamation is that in any but small juveniles, the individual head scales become extremely rough; the boundaries of the individual scales are impossible to determine because of their rugosity and because of the additionally obscuring effect of cephalic dark pigment. The casque assumes a very pebbled and dark appearance in many lizards, and the individual scale boundaries cannot be determined. Our comments on size of the casque scales depend upon examination of the few juveniles of the two species where the cephalic scales are not rugose and their boundaries are clearly determinable. However, the juvenile sample of both species is much too small to justify making any certain or quantitative statement regarding this feature; data are simply not determinable from subadult or adult *Chamaeleolis*, unless they are bleached from long immersion in preservative with resultant loss of pigment.

The altitudinal distribution of *C. porcus* ranges from sea-level (Playa de Guarda la Vaca) to elevations of 2000 feet (610 meters) in the Oriente mountains (El Yunque de Baracoa; Santa María de Loreto). Most examples are from lower elevations, but this may indicate only accessibility of habitat to collectors. The fact that

many of the UO specimens are the result of Ramsden's interest in these bizarre lizards with probable advice to workers on his *cafetales* to secure whatever specimens were seen is reflected in the locality data and relatively low to moderate elevations for the Ramsden material.

The series of *C. porcus* from La Florida offers some evidence of habitat and behavior of this species. La Florida lies very near or in the Sierra de Purial. The region is mountainous and the area where the lizards were collected is dark and moist; the forest is so dense that hardly any sunlight penetrates the canopy. Several of the lizards were in rose-apple (*Eugenia jambos* L.) woods and others were encountered on other trees. Associated anolines included *Anolis equestris* Merrem, *A. allogus* Barbour and Ramsden, and *A. angusticeps* Hallowell. The animals were very difficult to locate and with the exception of one which was surprised climbing on a tree trunk, other individuals tried to escape in the manner of *A. equestris* by running up the trunk. One *C. porcus* was encountered low on the trunk of a rose-apple; when the lizard became aware of the approach of the collector, it scurried to the opposite side of the tree and with great speed ascended the trunk. The tree was felled, but the lizard was not found. Another *C. porcus* ran up the trunk and, upon reaching the top, hid itself in the terminal leaves of a branch. When further pursued, this lizard leaped to the ground where it was captured. The senior author was guided to this precise locality by Sr. Rubio Suárez of Baracoa (to whom we are most grateful for assistance). Sr. Suárez stated that La Florida was the only locality in the Baracoa area where the "chipojo prieto" could be encountered.

From the above observations, it is apparent that *C. porcus* is at least capable of quick and decisive action. If the two species differed in their escape and activity patterns, these might as well be used to characterize them. The lethargic specimen cited by Wilson (1957) from Mina Carlota, Las Villas Province, is one of the three *C. porcus* from non-Oriente localities, however. Thus, *C. porcus* under some circumstances may be slow and deliberate and in others may react in the rapid pattern of *Anolis equestris*. There is still no evidence that *C. chamaeleonides* is also capable of such speedy activity.

Since natural history data on *Chamaeleolis* are so very limited, annotated labels made by Ramsden on two specimens of *C. porcus* and observations by the senior author are especially interesting. Of an adult female from Santa María de Loreto, with a snout-vent length of 170 mm, Ramsden recorded that an egg had been deposited on 4 September 1948 while the lizard was held in captivity. Two females from La Florida, collected by the senior author on 18 September 1965, contained well developed eggs; one egg measured 23 mm in length and was shelled and ready for deposition. In color and shape the egg was like that of *A. equestris.* A subadult male with snout-vent length of 110 mm was taken on a coffee bush in June 1949. This lizard died in captivity in September 1949, after having consistently refused a diet of fruit and roaches. Since Ramsden had found that *Anolis* and *Leiocephalus* readily ate fruit and roaches, he offered these items to *Chamaeleolis,* but completely without success.

Specimens examined. Cuba, Pinar del Río Prov., Rangel, 1 (MP); *Las Villas Prov.,* Mina Carlota, Sierra de Trinidad, 1 (MCZ 53598); Topes de Collantes, 1 (USNM 156786); *Oriente Prov.,* Playa de Guarda la Vaca, 1 (UO); Guarda la Vaca (not mapped), 1 (MCZ 47895); Isla Saetia, 1 (UMMZ 98014); Baracoa, 1 (USNM 29837); near Baracoa, 1 (MCZ 11205); La Florida, near Baracoa, 6 (IB 1088-89, IB 1091-93, ASFS V11172); El Yunque de Baracoa, 1000-1800 feet, 1 (MCZ 42507); costa sur, Baracoa, Punta Caleta, 1 (AMNH 17719); mountains north of Imías, 1 (MCZ 42503); 8 mi. NE Felicidad, 1 (AMNH 83626); Finca "La Rosita" de Borrero, Río Frío, El Cobre, 4 (UO); Hermanos Borrero (not mapped), 1 (UO); El Campanario, Guaso, Guantánamo, 1 (UO); Los Hondones, Guantánamo, 1 (UO); Bayate, Guantánamo, 10 (UO); Río Seco wood, San Carlos Estate, Guantánamo, 1 (UO); La Maya, 1 (MCZ 8501); Finca "Isabelita" de Ramsden, La Maya, 1 (UO); Santa María de Loreto, Loma los Ciegos, Ti Arriba, 2000 feet, 2 (UO); near Los Negros, Jiguaní, 1 (MCZ 8459).

Discussion

The distribution of the two species of *Chamaeleolis* is puzzling. The geographic evidence indicates that *C. porcus* is the species endemic to the massifs of extreme eastern Oriente Province (including, apparently, the Sierra Maestra, whence there is only the one record from Los Negros). The locus of origin of *C. chamaeleonides* is not so clear, since this species is virtually island-wide except for the eastern portion of Oriente. The abundance of records of *C. chamaeleonides* in the montane areas of Pinar del Río Province in western Cuba suggests that this species

has evolved there and has spread thence throughout most of Cuba, to and including the Sierra Maestra where the two species apparently at least approach one another closely. The abundance of records for the Sierra de los Organos and Sierra de Rosario in Pinar del Río may be due only to the attraction that these spectacularly scenic ranges offer for the collector. Absence of records for *C. chamaeleonides* throughout most of Matanzas, Las Villas, and Camagüey provinces does not imply that the species is absent there, but rather that much (but by no means all) of the lowland areas of these provinces has been denuded of its original forest cover for cultivation. Recently collected specimens from the Ciénaga de Zapata and near the city of Camagüey serve to demonstrate that the lizard is capable of surviving in more remote lowland areas (the former locality) or in woods in regions which are otherwise savanna or whence the forest has been removed (the latter).

The geographic picture is made more complex, however, by the occurrence of *C. porcus* in two outlying situations (the Sierra del Rosario in Pinar del Río; the Sierra de Trinidad in Las Villas) which lie within the known distribution of *C. chamaeleonides*. In the Sierra de Trinidad, *C. porcus* is the only known species (there are but two specimens of *Chamaeleolis* known from this range), but *C. porcus* appears to be greatly outnumbered by *C. chamaeleonides* in the Sierra del Rosario. If *C. porcus* is assumed to be strictly montane in its extra-Oriente distribution, its absence in the Sierra de Cubitas in Camagüey is puzzling; that range is apparently inhabited only by *C. chamaeleonides*. The Sierra de Cubitas, however, is lower in elevation than both the Sierra de los Organos-Sierra del Rosario massif on one hand and the Sierra de Trinidad on the other.

Chamaeleolis is unknown from the Isla de Pinos, but we imagine that it will ultimately be taken there. The Isla de Pinos has been so recently separated from the Cuban mainland that it seems very likely that *Chamaeleolis* (presumably *C. chamaeleonides*) reached the Isla de Pinos but remains as yet uncollected. Such densely wooded areas as the Paso de Piedras and the slopes of the Sierra de Casas and Sierra de Caballos would seem appropriate for these lizards. It is of interest to note that the equally large *Anolis equestris* occurs on the Isla de Pinos but has been

rather rarely collected there. [Since the present manuscript was completed, a pair of *C. chamaeleonides* was secured by Gilberto Silva and Jorge de la Cruz on 23 March 1967 at Santa Isabel, a wooded hill on the north side of the Ciénaga de Lanier. Santa Isabel is virtually surrounded by the waters of the Ciénaga, since a tongue of the Ciénaga borders it on the west. The surrounding flat lands are characterized by stands of the palm *Coccothrinax miraguano* Beccari.]

The genus *Chamaeleolis* belongs to the Island Alpha group of anoline lizards (Etheridge, *in litt.*), but it appears not to be closely related to other Alpha anoles on the islands in the western Caribbean (Cuba and Hispaniola). The degree of difference between *Chamaeleolis* and most other western Caribbean anolines (all of which are placed in *Anolis* with the exception of the remarkably divergent *Chamaelinorops* on Hispaniola) suggests that the genus has had a long and independent history from the balance of the Alpha group. *Chamaeleolis* may represent a local endemic Alpha development on Cuba, a relict member of a group of such distinctive anolines which has become extinct elsewhere, or a remnant of a previous invasion of this line of anoline evolution into Cuba. The usually slow and deliberate movements of *Chamaeleolis* suggest that its dispersal under its own locomotor powers might be extremely slow. For *C. chamaeleonides* to have reached much of Cuba also intimates that long periods of time have elapsed for such intra-island dispersal to have taken place.

We suggest that the two species of *Chamaeleolis* are the result of a very early invasion of Cuba by an Alpha anoline stock which has differentiated *in situ* there into two (eastern and western?) species which have diverged, in several scale and color repertory characters, to the species level. Both species have moved out from their regions of origin throughout most of the island; of the two perhaps *C. porcus* was primarily lowland and *C. chamaeleonides* primarily highland, although this may not have been the case at all. It is difficult to visualize situations wherein such usually phlegmatic and deliberate lizards would come into direct or even indirect competition either with other members of their own species or those of the other species, once the two have achieved overlapping ranges. Therefore, it is possible that there has been a gradually intermixing of the distributions of the two

species with no dichotomy of habitat (both are forest dwellers) or elevation (both, in the portions of their ranges where each is the sole species, occur in the lowlands and at least to intermediate elevations in the highlands).

The apparently relict western and central distribution of *C. porcus* today may well be an artifact of the seeming rarity of these lizards. The speed with which specimens of *Chamaeleolis* become available for study is matched by the customary slowness of the lizards themselves. Possibly, both *C. porcus* and *C. chamaeleonides* coexist over much of central and western Cuba, but the former species remains uncollected there. However, the fact that *C. porcus* is known from two isolated mountain massifs in western and central Cuba suggests that, during the Cenozoic inundations and emergences of Cuba and its later (pre-Miocene) status as an archipelago, lowland populations of *Chamaeleolis* have been exterminated, but that prior to this time both species were widespread on the island. Thus, lowland populations (of both species) were removed and both species were restricted to upland localities during periods of inundation. Such outliers of *C. porcus* on the Sierra del Rosario and Sierra de Trinidad, far removed from the "parent" population in the massifs of eastern Oriente, may well be remnants of long previous island-wide dispersions of *C. porcus*. If such an interpretation approaches fact, then the Pinar del Río mountains may well have been the place of origin of *C. chamaeleonides* and the eastern Oriente ranges that of *C. porcus*. The absence of *C. porcus* on the Sierra de Cubitas or the more southern Camagüey Sierra de Nasjasa may mean that at various times these lower lying ranges have been more completely submerged than the higher and more persistent areas in extreme eastern, central, and western Cuba. Once these lower ranges became permanent, they were recolonized by *C. chamaeleonides*.

In summary, we suggest that the disjunct distribution of *C. porcus* represents an old remnant distribution whose details have been profoundly affected by the Cenozoic history of Cuba. The more continuous distribution of *C. chamaeleonides* on the other hand would seem to be more recent—a Miocene or later dispersal from one or more refugia in eastern Cuba. This interpretation requires that *C. chamaeleonides* is the more vagile and that it has

in a relatively short time re-expanded its range from the western to the eastern portion of the island. *C. porcus,* on the other hand, remains restricted primarily to its old range in the mountainous section of eastern Oriente, with two relict outlying populations in higher mountain ranges in central and western Cuba.

Resumen

Se creía que el endémico género cubano *Chamaeleolis* (Iguanidae) contenía una sola especie, la *C. chamaeleonides* Cocteau. Pero en realidad existen dos especies, la segunda siendo *C. porcus* Cope. Las diferencias entre las dos especies son: 1) escamas gulares paramediales pequeñas, cortadas, cónicas y piramidales en la *chamaeleonides;* largas y flexibles en la *porcus;* 2) escamas supralabiales separadas del anillo de escamas circumorbitales por una hilera de escamas en la *chamaeleonides,* aquéllas en contacto en la *porcus;* 3) en la *chamaeleonides* las escamas dorsales son subcirculares con muchas escamas interstitiales, en la *porcus* las cuatro filas de escamas más dorsales son más largas que anchas y con pocas o ninguna escama interstitial, y el resto de las escamas dorsales carecen de escamas interstitiales; 4) en la *chamaeleonides* la distancia del hocico al borde anterior de la órbita corresponde a un numero entre 42 y 83 de escamas ventrales, siendo estas pequeñas o diminutas; en la *porcus* la mencionada distancia contiene de 22 a 48 escamas, lo que indica que las escamas ventrales son más grandes; 5) las escamas debajo del ángulo de la boca son muy ásperas en la *chamaeleonides,* poco ásperas o lisas en la *porcus.*

C. chamaeleonides se encuentra por casi toda la isla con excepción del este de la provincia de Oriente (al este de la línea Gibara-Pico Turquino). *C. porcus* reside principalmente al este de la línea Gibara-Pico Turquino, pero se la encuentra tambien en la Sierra de Trinidad en Las Villas (dos ejemplares) y en la Sierra del Rosario en Pinar del Río (un ejemplar).

La historia de la geología cubana explica dichas distribuciones. Se propone que la *porcus* fue la especie endémica de las sierras orientales y la *chamaeleonides* la de las sierras pinarenses. La presencia de la *porcus* en dos zonas lejos de la zona principal de la especie en Oriente sugiere que antiguamente ambos especies de distribuyeran por todas partes de las isla. Esta antiguas extensiones geográficas se modificaron profundamente en el período cenozóico cuando Cuba estaba submergida y las poblaciones de las dos especies fueron extirpadas en los llanos, dejando poblaciones relictas de la *porcus* en las sierras más occidentales. Cuando Cuba obtuvo su configuración actual, *C. chamaeleonides* volvía a extender su distribución por toda la isla mientras que *C. porcus* está restringida a los residuos de una distribución anteriormente más amplia.

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